

7700 HB EXHIBIT

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Remote Sensing / Infrared Resources

The purpose of this Exhibit is to provide information regarding the capabilities of remote sensing resources that are available through public agencies during fire emergencies. Remote Sensing resources provide crucial data and intelligence to incident and operational staff. The data and services provided by remote sensing assets can be used to improve the situational awareness of those working on an incident and provide fire perimeter information for both incident Geographic Information Systems Specialist (GISS) staff and Geographic Area Coordination Center (GACC) Intelligence functions. This Exhibit covers resources offered by the National Infrared Operations Unit (NIROPS); USFS FireWatch; USGS satellite imagery; and the California Air National Guard. A description of each resource is provided below.

USFS Remote Sensing Resources - Platform Description and Mission for US Forest Service Resources

National Infrared Operations Unit (NIROPS)

The USFS operates a fleet of three infrared platforms: a Cessna Citation Bravo II, a King Air B-90 and a King Air B-200. The mission of the USDA Forest Service Infrared Mapping Section is to provide accurate, high-quality infrared imagery to an incident in a timely manner. NIROPS, with the assistance of the [Remote Sensing Applications Center](#) (RSAC) in Salt Lake City, Utah, are tasked to stay "up-to-date" on emerging infrared technologies and their applications for wildfire suppression. The Forest Service determined that an airborne 2 channel Infra-Red (IR) line scanning system is the optimal choice for forest fire surveillance.. The driving factors for use of imaging technology for fire management are 1) ability to detect fire accurately with a low false report rate. 2) rapid data collection. 3) timely delivery of information. Thermal infrared line scanner technology provides accurate fire detection capabilities along with imagery useful for managing fire containment.

Capabilities and Examples of Uses for NIROPS

- Fire detection
- Heat and intense heat area detection
- Fire perimeter mapping

Deliverables Format for NIROPS

- GIS Shapefile
- Imagery
- Fire perimeter and heat area map

Ordering Procedure for NIROPS

[Refer to HB8100 Procedure 329 Resource Ordering – Remote Sensing / Infrared](#)

USFS FireWatch

Platform Descriptions and Mission for FireWatch

The FireWatch Program utilizes two Bell 209 Cobra helicopters, owned by the U.S. Forest Service, equipped with specialized equipment for intelligence gathering, mapping, command, and control. One helicopter is based out of Redding, CA and one helicopter is based out of Lancaster, CA. The aircraft is equipped with avionics to perform aerial supervisory missions equal to, or above the National Standard Type 1 Air Tactical Group Supervisor (ATGS) platform as recognized in the National ATGS Platform typing in the National Mobilization Guide.

The Forward Looking Infra Red (FLIR) Systems Star Safire III Turret is equipped with multiple infrared sensors, 3CCD color camera, laser range finder, laser illuminator, and spotter scope. The FLIR Turret is integrated to work with a computerized mapping program (Avaalex system) that can display street, topographic and aeronautical maps. Maps can be edited to show points of interest and calculate distances and area. On top of the aircraft is a second fixed infrared sensor (Max-Viz) that recovers images in the 8-12 micron wavelength range vs. the 3-5 micron mid-wave range of the turret mount.

The aircraft is equipped with a multi-channel microwave transmitter capable of down linking real time color or infrared sensor images and cockpit audio to a portable microwave receiver. A portable microwave receiver will be carried on the aircraft, for delivery to personnel on an incident. This will supplement the Data Recovery Van when in route to an incident.

The Data Recovery Van is equipped with a microwave receiver and directional antennae, flat screen video display, VCR recorder, and DVD recorder. This vehicle will accompany the helicopter and serve as the remote receptor of data to an incident command organization.

The aircraft can make landings in areas that can accommodate a Type 2 helicopter. It is possible for the ATGS to perform intelligence-gathering duties, land and have a face-to-face meeting with the Incident Commander (IC) or other incident staff. Delivery of current intelligence in the form of a GIS compatible map can be hand delivered by physical delivery of a "jump drive" or via email through a Global Star satellite phone in flight. The shape files created by the aircraft can be reprocessed in the GIS Van to suit the end user..

Live video down linking can be delivered to a portable microwave receiver that is normally carried in the aircraft. The portable microwave receiver range is approximately 2 miles. The GIS Van has microwave receiving capability of 20 mile line of sight range. The GIS Van is the processor of map data received from a FireWatch helicopter and projector of the live video data. The duties of the data van operator may include: Determining the correct ICS personnel to which to deliver the data and information, locating a suitable site for data recovery at or near an incident command post, and processing shape files for a GIS specialist attached to the incident.

Capabilities and Examples of Uses for FireWatch

- Fire and heat detection
- Fire perimeter mapping

Deliverables Format for FireWatch

- GIS Shapefile
- Live video feed

Ordering Procedure for FireWatch

[Refer to HB8100 Procedure 329 Resource Ordering – Remote Sensing / Infrared](#)

USGS Satellite Imagery

Platform Descriptions and Mission for USGS Satellite Imagery

The USGS acts as the Federal Emergency Management Agency's (FEMA) executive agent for aerial and satellite imagery. They procure aerial and satellite imagery in preparation or in response to disasters. They also work to coordinate data sharing between state, federal and local agencies, holding daily imagery teleconferences during disaster response situations in order to meet the needs of first responders on the ground.

The USGS can coordinate:

- Environmental Protection Agency's (EPA) airborne spectral sensor
- Civil Air Patrol's assets
- Sensors from the National Oceanic and Atmospheric Administration
- Planes from the National Guard Bureau
- LIDAR and hyperspectral imagery from the U.S. Army Corps of Engineers
- Commercial imagery from the National Geospatial-Intelligence Agency.

Many of these satellites capture images at relatively moderate resolutions, making them useful for large-area applications. Precise, smaller-scale analysis of a disaster's impact, such as assessing damage to buildings and infrastructure following an earthquake, requires a more detailed view.

GeoEye and DigitalGlobe own and operate Earth-imaging satellites that acquire very high-resolution images, for example DigitalGlobe can capture panchromatic images with a resolution of one meter or less. While there is normally a cost associated with obtaining high-resolution commercial satellite scenes, the two companies will donate some archived imagery and also provide newly tasked imagery at a reduced cost to USGS. First responders and end users of the system will then have access to this data at no cost to the State.

"Eagle Vision" Systems imagery data, a family of systems developed for the U.S. Air Force and operated by the Air National Guard, can also be obtained through USGS. See more detailed information on this resource in the ["Eagle Vision" section](#).

Capabilities and Examples of Uses for USGS Satellite Imagery

- Can direct downlink commercial imagery, depending on which Eagle Vision satellite is being tasked.

- With most of these satellites, incident staff could easily see fire perimeter, often we do not need IR interpreter to identify burned areas.
- Fairly quick turn-around from image collection to dissemination (less than 6 hours)
- Imagery provided by Eagle Vision **MAY NOT** be used for law enforcement purposes.
- Imagery can be used to determine accurate perimeter if no other intelligence is available. Multispectral systems can help validate fire perimeter location provided by other sources. A Fire perimeter stands out well in SPOT Imagery.
- Smoke can be used to determine areas of active burning (to enhance firefighter situational awareness).
- Fire Perimeter and Hotspot Detection data can be integrated into USFS/USGS Infrared Analysis process to derive accurate fire progression and mapping for incident teams.
- Direct downlink data can provide large area situational awareness
- Fire Behavior Support
 - Review incomplete consumption of vegetation within perimeter and along edge and head of fire.
 - Assist in fire intensity assessment based on consumption of wild land vegetation.
- Recovery and rehabilitation
 - Assess damage to natural resources
 - Examine fire area for burn intensity
 - Determine areas with minimal damage
 - Use imagery from before and after fire burned in change detection
 - Assess damage to civil infrastructure
 - Quick determination of location of damaged structures
 - Determine extent of damage
 - Use burn intensity to identify areas where more intense rehabilitation is necessary due to:
 - Soil damage
 - Vegetation damage
 - Combined with Digital Elevation Model (DEM), post fire slope stability could be assessed
 - This could identify where assets could be at risk to erosion and slides
 - Identify risk to populated areas
 - Adjusted image bands for better visualization of burned area

Deliverable Format for USGS Satellite Imagery

- Imagery at various spectral and spatial resolutions

Access Procedure for USGS Satellite Imagery

USGS satellite imagery data is disseminated by USGS on the Hazard Data Distribution System (HDDS).

The generic site: "<http://hdds.usgs.gov>" provides information on HDDS.

Use the following link to register for access to HDDS:

["http://hdds.usgs.gov/hazards-data-distribution-system-hdds"](http://hdds.usgs.gov/hazards-data-distribution-system-hdds)

Follow the instructions on this web page to complete the registration process. To gain access to “Restricted” data sets, you must follow the instructions on the above website to submit a request. You may be able to request to have imagery data posted to other sites depending on the event and the agencies involved.

When ordering satellite imagery, you must provide the latitude and longitude coordinates for the north and south (latitude), and east and west (longitude) boundaries of the area you would like imagery captured. The ordering point must provide the coordinate boundaries in the Mapping Block section of the [Remote Sensing Resource Check List](#) and must also select the desired options from the check list.

California Air National Guard Remote Sensing Resources

Platform Descriptions and Mission for Air National Guard Resources

The Air National Guard has several remote sensing resources available for emergency response. These vary from Color/IR Full Motion Video (FMV) to satellite imagery (Eagle Vision), both with several options.

If you only want to receive imagery data and not have it analyzed/interpreted, use [Access Procedure for USGS Satellite Imagery](#) to obtain the imagery data. “Eagle Vision” should only be ordered through the California Military Department (National Guard) if you want the Eagle Vision imagery analyzed/interpreted in order to produce one or more of the products listed in the [Eagle Vision section](#) below.

The National Guard resources are to be ordered based on the products/services and options desired, rather than ordering the actual resource itself. The ordering point must select the desired options from the [Remote Sensing Resource Check List](#). Using information from the check list, CAL FIRE and National Guard personnel will work together to determine the most applicable resources to meet the mission objectives.

RC-26

The RC-26 consists fleet of 11 RC-26 aircraft throughout the country that have been a key asset assisting law enforcement with counterdrug efforts, and U.S. Customs and Border Patrol agents with border security. One of these aircraft is stationed at the California Air National Guard (CANG) base in Fresno, California and is available for all-risk emergency assignments (when not mobilized for federal combat or other missions). The RC-26 aircraft has a digital video camera in a Gimbal mounted pod beneath the aircraft which is capable of shooting both color and infrared (IR) full motion video of an emergency incident. The live video can be down-linked to portable receivers at the Incident Command Post (ICP) and can be ported to the internet. This platform can be used for both operational and planning purposes. Being live, real-time video, personnel working on the fire can immediately see what the fire is doing. This is especially useful when conditions on the ground are too smoky for incident staff to personally observe the fire or in remote areas where survey from the ground is difficult.

Capabilities and Examples of Uses for the RC-26

- Flies at an altitude of ~17,000 feet, which is well outside incident temporary flight restriction zones (TFR).
- Flight crew includes pilot, co-pilot and Mission Systems Officer (MSO).
- When available, a firefighter with incident operations experience should be on board to assist the MSO with communications with incident personnel, and understanding incident operations and terminology.
- The RC-26 provides real-time infrared (IR) and full motion video (FMV) imagery of a fire to an incident base.
- The IR video can be down linked to portable receivers or an internet web site at the incident base or fire line and ported to the internet where it can be viewed live by incident staff. You must order a support crew to set up and run the necessary equipment if you wish to view streaming video live on the internet while the aircraft is in flight. Staff on board the RC-26 will make arrangements to get a portable receiver to the incident base if the flight will be less than 30 miles from the base and have line of sight communications with the aircraft.
- The camera can be easily switched between IR and color video at any time.
- Prior to the flight, incident personnel can provide coordinates of locations they would like to have scanned by the system. The desired areas/locations to scan can also be provided to the MSO in the form of point, line or polygon GIS shapefiles.
- Incident staff can communicate to the RC-26 MSO via dedicated air-ground frequency in order to communicate with the MSO and to have the camera pointed to the desired location.
- MSO onboard the RC-26 can save snapshot digital images (IR or color) while shooting FMV video.
- While observing the video in flight, the MSO can add points to the system on the fire perimeter, hot spots or spot fires, which can be downloaded as GIS shapefiles.
- Upon landing, if provided a USB flash drive (16 GB or larger), the MSO can provide to incident personnel the video, snapshots and GIS data collected during the flight.
- The basic product would be a flash drive containing a video, snapshots and GIS data collected during the flight (see flash drive requirements above).

Deliverable Format for RC-26

- GIS Shapefile
- Live streaming video feed
- Video and snapshots
- Web service
- Xml files

Ordering Procedure for RC – 26

[Refer to HB8100 Procedure 390 Resource Ordering - California National Guard \(CNA\) Resources for ordering procedure.](#)

UH-72 Lakota

The UH-72 Lakota is a twin engine, multi-role helicopter that has the same remote sensing capabilities as the RC-26, but **cannot import/export GIS data files**.

Capabilities and Examples of Uses for the UH-72 Lakota

The UH-72 Lakota flies at much lower altitudes than the RC-26, which provides a different perspective of the incident. It can also be used by incident personnel for reconnaissance and other types of incident missions. Since the system is not capable of importing and exporting GIS data, the MSO can export coordinates of desired features they discover while flying on the incident to an XML file that can be converted in Microsoft Excel to a format suitable for use in ArcGIS software. Specific coordinates of the features you are interested in are needed. As with the RC-26, incident personnel must provide the MSO with a USB flash drive (16 GB or larger) in order to copy the video and snapshots.

Deliverable Format for UH-72 Lakota

- Live streaming video feed
- Video and snapshots
- Web service
- Xml files that can be converted to GIS Shapefile

Ordering Procedure for UH-72 Lakota

[Refer to HB8100 Procedure 390 Resource Ordering - California National Guard \(CNA\) Resources for ordering procedure.](#)

Eagle Vision

The Eagle Vision Systems is a family of systems developed for the U.S. Air Force and operated by the Air National Guard, which downlinks and processes commercial satellite imagery (SPOT, Landsat, Radarsat, IRS, and Orbview). The system will output multi-spectral and panchromatic, relatively broad-area coverage (60km X 60km) digital raster imagery products that will support air operations, GIS specialists and intelligence analysts.

Eagle Vision III (EV3) is composed of two elements, a data acquisition segment (DAS) which includes an antenna and a shelter that collects and processes imagery into a standard format, and a transit-cased data integration segment (DIS) that processes the standard format products into useful products for an incident commander's mission planning and intelligence gathering.

Eagle Vision systems are located at four sites in the U.S, including; EV3-San Diego, California, EV4-Columbia, South Carolina, EV5-Honolulu, Hawaii, and EV6-Huntsville, Alabama with up to seven satellites accessible to meet the 24/7 demand.

When ordering satellite imagery from Eagle Vision, you must provide the latitude and longitude coordinates for the north and south (latitude), and east and west (longitude) boundaries of the area you would like imagery captured. The ordering point must provide the coordinate boundaries in the Mapping Block section of the [Remote Sensing Resource Check List](#) and must also select the desired options from the check list.

Capabilities and Examples of Uses for Eagle Vision Satellite Imagery

Eagle Vision provides the same capabilities as those listed for USGS Satellite Imagery, but in addition to receiving the imagery products, National Guard technicians will analyze/interpret the imagery and provide the products listed below:

- Polygon shapefile containing polygons of heat areas identified in the imagery
- Polygon shapefile containing the entire fire perimeter as identified in the imagery
- Polygon shapefile containing the actively burning areas along the fire perimeter as identified in the imagery
- Change detection identified using pre and post imagery

Deliverable Format for Eagle Vision Satellite Imagery

- Satellite Imagery
- GIS Shapefile

Ordering Procedure for Eagle Vision Satellite Imagery through California National Guard

[Refer to HB8100 Procedure 390 Resource Ordering - California National Guard \(CNA\) Resources for ordering procedure.](#)

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